(vi) the extracellular domain is connected to the transmembrane domain by a hinge region.

10.-**11**. (canceled)

12. The T cell of claim **1**, wherein:

(i) the first nucleic acid sequence comprises an RNA,

(ii) the second nucleic acid sequence comprises an RNA, or

(iii) the first and the second nucleic acid sequence each comprise RNA.

13.-**14**. (canceled)

15. The T cell of any of claim **12**, wherein:

(i) the T cell is transfected to transiently express the first and/or second RNAs,

(ii) the cell does not comprise an exogenous DNA encoding the first or second RNA,

(iii) the first and/or second RNAs are generated by in vitro transcription,

(iv) the first and/or second RNAs are synthetic RNAs, or

(v) the first and/or second RNAs are introduced into the T cell by electroporation.

16.-**19**. (canceled)

20. The T cell of claim **1**, wherein the CAR further comprises one or more costimulatory signaling domains, and wherein the first and/or second nucleic acid sequence comprises DNA or cDNA.

21. The T cell of claim **1**, wherein:

(i) the first and/or second nucleic acid sequence comprises a vector,

(ii) the first and/or second nucleic acid sequence comprises a viral vector,

(iii) the first and/or second nucleic acid sequence comprises a retroviral vector or a lentiviral vector, or

(iv) the T cell is virally transduced to express the first and/or second nucleic acid sequence.

22.-**24**. (canceled)

25. The T cell of claim **1**, wherein the extracellular domain of the CAR comprises an antigen-binding domain, wherein:

(i) the antigen-binding domain is an scFv domain,

(ii) the antigen-binding domain binds to an antigen associated with a disease state wherein the disease state is selected from the group consisting of a proliferative disease, a precancerous condition, a non-cancer indication, a viral infection, and a bacterial infection,

(iii) the antigen-binding domain binds to a tumor antigen, a viral antigen, or a bacterial antigen, or

(iv) the antigen-binding domain binds to a tumor antigen, wherein the tumor antigen is an antigen associated with a cancer selected from the group consisting of brain cancer, bladder cancer, breast cancer, cervical cancer, colorectal cancer, liver cancer, kidney cancer, lymphoma, leukemia, lung cancer, melanoma, metastatic melanoma, mesothelioma, neuroblastoma, ovarian cancer, prostate cancer, pancreatic cancer, renal cancer, skin cancer, thymoma, sarcoma, non-Hodgkin's lymphoma, Hodgkin's lymphoma, uterine cancer, and combinations thereof.

26.-**30**. (canceled)

31. The T cell of claim **9**, wherein the costimulatory signaling domain is a functional signaling domain from a protein selected from the group consisting of OX40, CD27, CD28, CD30, CD40, PD-1, CD2, CD7, CD258, NKG2C, B7-H3, a ligand that binds to CD83, ICAM-1, LFA-1 (CD11a/CD18), ICOS and 4-1BB (CD137), or any combination thereof.

32. The T cell of claim **1**, wherein the polypeptide which enhances T cell priming is selected from the group consisting of a costimulatory molecule, a soluble cytokine, a polypeptide involved in antigen presentation, a polypeptide involved in trafficking and/or migration, or a polypeptide involved in dendritic cell (DC) targeting, or a functional fragment or variant thereof.

33. The T cell of claim **32**, wherein:

(i) the costimulatory molecule is selected from the group consisting of CD70, CD83, CD80, CD86, CD40, CD154, CD137L (4-1BBL), CD252 (OX40L), CD275 (ICOS-L), CD54 (ICAM-1), CD49a, CD43, CD48, CD112 (PVRL2), CD150 (SLAM), CD155 (PVR), CD265 (RANK), CD270 (HVEM), TL1A, CD127, IL-4R, GITR-L, CD160, CD258, TIM-4, CD153 (CD30L), CD200R (OX2R), CD44, ligands thereof, and functional fragments and variants thereof,

(ii) the soluble cytokine is selected from the group consisting of: IL-2, IL-12, IL-6, IL-7, IL-15, IL-18, IL-21, GM-CSF, IL-18, IL-21, IL-27, and functional fragments and variants thereof,

(iii) the polypeptide involved in antigen presentation is selected from the group consisting of CD64, MHC I, MHC II, and functional fragments and variants thereof,

(iv) the polypeptide involved in trafficking and/or migration is selected from the group consisting of CD183, CCR2, CCR6, CD50, CD197, CD58, CD62L, and functional fragments and variants thereof, or

(v) the polypeptide involved in DC targeting is selected from the group consisting of TLR ligands, anti-DEC-205 antibody, an anti-DC-SIGN antibody, and functional fragments and variants thereof.

34.-**41**. (canceled)

42. The T cell of claim **1**, wherein:

(i) the T cell has enhanced antigen presentation ability relative to a T cell which lacks the second nucleic acid sequence,

(ii) the T cell has enhanced T cell priming ability relative to a T cell which lacks the second nucleic acid sequence,

(iii) expression of the polypeptide encoded by the second and/or additional nucleic acid sequences does not substantially affect the cell-killing function of the CAR encoded by the first nucleic acid sequence,

(iv) the T cell has increased efficacy in killing tumor cells or reducing tumor size in a subject with a tumor relative to a T cell comprising only the first nucleic acid sequence, or

(v) the T cell enhances the priming of T cells with a tumor antigen, a viral antigen, a bacterial antigen.

43. (canceled)

44. The T cell of claim **1**, wherein the T cell is transfected to transiently express a nucleic acid comprising a third nucleic acid sequence encoding a polypeptide which enhances T cell priming, or a functional fragment or variant thereof, which differs from the polypeptide encoded by the second nucleic acid sequence.